to the Royal Agricultural Society, on their Slide No. III. (The three free zoospores are from a drawing by De Bary.) The septate aerial branches of the fungus, named conidiophores are seen at A A. The characteristic vesicular swellings peculiar to the potato-fungus at B B. Immature conidia at C C, and mature conidia at D, the latter showing the contents differentiating into zoospores. The zoospores are shown free at E E. The mycelium and conidiophores of *Peronospora infestans* are generally furnished with septa (A A) but this character is liable to great variation. The conidia are at first terminal (G) with no swelling on the thread below, but as the threads grow they push off the old conidia and continue to produce new ones on each newly formed apex. De Bary explains this phenomenon by saying, "When the first conidium is ripe, it is pushed to the side by an unequal swelling of the point to which it is attached. The top of this swollen portion then begins to grow in the original direction of the branch into a new conical point; and when this has reached a length equal to that of a conidium, or a conidium and a half, a new conidium is produced at the apex." I take this to be only partially correct, for the more reasonable explanation of the vesicular swellings on the threads is that the thread is constantly making an effort to produce new conidia, and each swelling is really an *abortive conidium*: each of these pieces will grow in water if free, as will the immature dust-like conidia (C C) the latter are being pushed off at M M. On looking at point B, it will be seen that the swellings there illustrated have never produced terminal conidia at all, but that each successive swelling is in itself an *attempt* to become one. Instead of these bodies *when terminal* growing to the length of "a conidium or a conidium and a half" they commonly remain the mere fourth or sixth part of a conidium in length, and often less, and never produce conidia. At J will be seen a double swelling: the first effort of the thread fell short, and the attempt to produce the conidium was renewed: such double swellings are common; a terminal one occurs at K. Vesicular swellings occur on all parts of the conidiophore; they are frequent at the base, commonly irregular as at L and always (to me) represent an attempt at fruit production.

It may just be well to remark that the suggestion as to the possibility of the oospores of *P. infestans* being ultimately found on some plant different from *Solanum tuberosum* is very old, and that Mr. Berkeley has recently found the potato-fungus growing upon the garden Petunia, this plant, we believe, has not been given in any previous list, and its importance must not be overlooked, for the Petunias come from the native country of the potato, one garden species even coming from Chili.

Prof. De Bary is not right in his surmise that he was "perhaps" the first to call attention to the perennial mycelium of the potato-fungus in 1863; Mr. Berkeley did this in 1846 and the fact has been confirmed by many observers since. The subject is thoroughly old and is discussed in our popular books; for instance—see vol. xiv. of the "International Series" Fungi (p. 156), where Dr. M. C. Cooke says, "The Peronospora of the potato is thus perennial by means of its mycelium." Most fungi depends for their existence upon "perennial mycelium." The "spawn" of the common mushroom is a good and well known example. A mycelium may however be perennial and yet produce oospores.

WORTHINGTON G. SMITH

OUR ASTRONOMICAL COLUMN

THE OCCULTATION OF SATURN, AUGUST 7, A.M.—Perhaps some observers who are provided with good telescopes may be induced to look for the occultation of the planet Saturn, on the morning of August 7, although (in the south of England) the immersion does not take place until half an hour after sunrise, and at emersion Saturn is only some five degrees above the south-western horizon.

Reference is made to the phenomenon here with the view to illustrate the use of the method of distributing predictions over a given geographical area, explained by Mr. W. S. B. Woolhouse in the *Companion to the Almanac* for 1871, as applicable to the phases of a solar eclipse, to the approximate prediction of the times of immersion and emersion of a star or planet in a lunar occultation, and the angles on the moon's limb at which they occur, at any place within the given area or very near to it. It is founded upon the assumption that the value to be determined is a linear algebraic function of the latitude and longitude of the place, for which the calculation is to be made. On this assumption the time (t), of any phase, &c., may be expressed thus:—

$$t = c + p.\ \mathrm{L} + q.\ \mathrm{M}.$$

where c, p, and q are three constants to be found.

If now direct calculations of the particulars of any phenomenon be made for three places moderately distant as Greenwich, Dublin, and Edinburgh, the constants will be determined by the substitution of the results, which supply the three equations of condition necessary. If the difference Greenwich—Dublin be called h, and Greenwich—Edinburgh k, then, as calculated by Mr. Woolhouse:—

$$p = 0{\cdot}1425\,h - 0{\cdot}2840\,k$$
$$q = 0{\cdot}05014\,h - 0{\cdot}02137\,k$$
$$c = \mathrm{G} - 1{\cdot}4772\,k.$$

G being the result of the computation for Greenwich.
Also L is latitude − 50°, expressed in degrees and decimals.
And M is longitude from Greenwich, + if east, − if west, in minutes of *time* and decimals.

Applying this method to the occultation of Saturn we have, by direct computation for Greenwich, Dublin, and Edinburgh (astronomical times at Greenwich, Aug. 6):—

	Immersion.	Emersion.	Angle N.Pt. Immersion.	Angle N.Pt. Emersion.
	h. m.	h. m.	°	°
Greenwich ...	17 7·53	18 3·10	94·6	331,1
Dublin ...	17 0·25	18 2·35	107·6	319,0
Edinburgh ...	17 0·25	18 2·38	111·2	313,8

The necessary data being taken from the *Nautical Almanac*, and the angles expressed as usual in that work.

Thus we find for Greenwich time of immersion and emersion at any place in this country, and for the angles on the moon's limb from north point:—

		h. m.			
Immersion ...	Aug. 6	17 9·05	− 1·03 L	+ 0·21 M.
Emersion ...	,,	18 3·24	− 0·10 L	+ 0·02 M.
		°			
Angle Imm.		90·3	+ 2·9 L	− 0·3 M.
Angle Em.		336·3	− 3·5 L	+ 0·2 M.

The differences between the results of these equations and direct calculations for Exeter and Liverpool are:—

	Exeter.	Liverpool.
	m.	m.
Immersion	− 0·2	+ 0·2
Emersion	+ 0·1	− 0·3
	°	°
Angle Imm.	+ 0·3	− 0·2
Angle Em.	+ 0·1	+ 0·1

In this manner have been derived the following particulars, as regards the occultation in question, which will illustrate the applicability of Mr. Woolhouse's method to such phenomena:—

	G.M.T. of Immersion.	G.M.T. of Emersion.	Angles from N. point. Imm.	Em.
	h. m.	h. m.	°	°
Aberdeen ...	16 59·9	18 2·4	113	310
Cambridge ...	17 6·9	18 3·0	90	329
Exeter	17 5·6	18 2·7	96	331
Glasgow ...	16 59·4	18 2·3	112	312
Liverpool ...	17 2·8	18 3·0	104	322
Manchester ...	17 3·6	18 2·7	103	322
Nottingham ...	17 5·9	18 2·9	99	326
Oxford	17 6·1	18 3 0	97	329
Portsmouth ...	17 7·3	18 3·1	94	332
York	17 4·9	18 2·8	102	322

NEW RED STAR.—Mr. Birmingham, Millbrook, Tuam, mentions (*A. N.*, 2,092) his having remarked an intensely red star, 8·5 magnitude, which is not in Schjellerup's catalogue (*Vierteljahrschrift der Astron. Gesellschaft*, ix. Jahrgang, Heft 4). From the approximate position given the star appears to be No. 3,168, + 36° in *Durchmusterung*, where it is also estimated 8·5, and its position 1855·0 is R.A. 18h. 27m. 19s., N.P.D. 53° 7′. It has not been found in any other catalogue.

THE DOUBLE STAR Σ 3,121.—This object well merits the attention of observers who are in the possession of large telescopes. Baron Dembowski seems to have given it up for the present as beyond his instrumental means. It is evidently a binary of no long period. For comparison we have—

Struve ...	1832·31	Position	20·0	Distance	0·85
Dembowski..	1866·22	,,	189·7	,,	0·68
,,	1872·23	,,	210·5	,,	a wedge
,,	1875·31	,,	252·0	,,	oval.

The place of this star for 1876·0 is in R.A. 9h. 10m. 32s., N.P.D. 60° 53′·8.

THE LOAN COLLECTION CONFERENCES.

THE work in connection with the South Kensington Conferences has been carried on heartily and successfully during the past week. The number of visitors to the collection has been, all things considered, satisfactory, and the conference-room is always well filled.

Of the papers in the Section of Mechanics read on the 17th inst., M. Tresca's, on the "Flow of Solids," possessed some novelty and interest. From his experiments he drew inferences as to the proper form and mode of application of tools, explained the theory of many of the adjustments which workmen have found out by rule of thumb, and indicated extensions of the use of the principles now reduced into formulæ. He added that, in his belief, these mechanical laws ought to be pursued into physiology, and that the accretion of cell to cell was a mechanical phenomenon.

The conversazione given by the Physical Society the same evening was brilliant and successful.

At the meeting of the Chemical Section last Thursday, Dr. Frankland gave a long and highly important address, mainly on eudiometric apparatus. This address we give this week *in extenso*. Dr. J. H. Gilbert, F.R.S., then gave an interesting lecture on "Some Points connected with Vegetation." Mr. W. F. Donkin, M. A., then gave a description of the ozone apparatus of Sir B. Brodie, Bart., F.R.S., after which Prof. Andrews, F.R.S., concluded the meeting with an account of some experimental investigations in connection with the physical constitution of gases.

On Friday was held the second Conference in connection with the Physical Section. The conference-room throughout the day was unusually well filled. The first communication was from Prof. Tyndall, F.R.S., on the "Reflection of Sound." With the help of Mr. Cotterell, his assistant, he reproduced some of the experiments with sensitive flames with which he has made scientific audiences so familiar.

Dr. Stone spoke on the subject of "Just Intonation and the Limits of Audible Sound." Mr. R. H. M. Bosanquet, M.A., spoke on "Instruments of Just Intonation," and explained the construction of the enharmonic harmonium contributed by him to the collection.

Mr. F. Galton, F.R.S., in his remarks "On the Limits of Audible Sound," spoke of experiments which he had been trying for some time past on the susceptibility of various animals to the highest notes, such as those of extremely small whistles. He had arrived at the conclusion that no animals were so sensitive to sounds of the character in question as cats, which, of course, were the animals produced by natural selection to prey upon those other animals which in nature produced such sounds—namely, mice.

Prof. W. G. Adams, F.R.S., spoke on the late Sir C. Wheatstone's acoustical discoveries, and Mr. W. Chappell followed with a discourse "On Ancient Musical Science."

Mr. J. Baillie Hamilton spoke on Æolian instruments. He gave a history of the attempts in Europe to combine wind and string, and coming down to the present time he spoke of his own experiments. He has found that a metallic ring of suitable elasticity well supplies the place of a string's constraint on a vibrator. Variations in the shape of the ring produce differences of tone. Thus, passing from the circle to almond-shaped rings, all qualities from the flute to the horn are created.

M. Tresca referred to the still existing monuments of the history of science. For various reasons, want of appreciation, want of care, &c., many instruments of historical interest are lost. France is relatively well off in its historical instruments, and it is well represented in this exhibition. M. Tresca then referred to the instruments in the collection France has sent over, giving a graphic sketch of their history and the history of the progress of the sciences they have helped forward. The Earl of Rosse, F.R.S., made a brief communication on the thermopiles which he is now using in connection with the telescopes belonging to the late Earl, after which Mr. De la Rue described his electric batteries of a novel construction. The Cavaliere Prof. De Eccher made a communication on the instruments sent over from Italy.

The conversazione given by the Geographical Society on Saturday evening was in all respects a successful one; more than 2,000 persons accepted the invitations sent out.

In the second meeting of the Mechanical Section on Monday, the first paper was by Prof. Kennedy, on "Reuleaux's Collection of Kinematic Models." Prof. Kennedy explained the general principles and some of the details of these educational models designed by their constructor for the illustration of the theory of machines. Mr. W. Barnaby, C.B., then read a paper on "Naval Architecture," which we hope to publish in our next number. Mr. W. Froude, F.R.S. then gave a short lecture on "Fluid Resistance," detailing many of his experiments. The other papers read were by Mr. Thomas Stevenson, on "Lighthouses," M. le Général Morin on "Ventilation," Messrs. Dent on "Time-measurers," and Mr. J. N. Douglass, C.E., on "Instruments contributed by the Trinity House."

The Chemical Section met again on Tuesday. The President, Dr. Frankland, F.R.S., read a communication from M. le Professeur Frémy, the French Chemist, on the Diminution of Scientific Research. M. Frémy has founded and carried on during the last twelve years a laboratory for the prosecution of original investigations by students who have completed their scientific studies. The experience which he has gained is such as to lead him to the conclusion that it is necessary to invoke state aid in order to restore research to that position which it should occupy. As the State chooses its officers and engineers after a severe course of study, and then ensures their regular advancement in its service, M. Frémy claims a similar boon on behalf of pure science, which renders such invaluable services to the community. He proposes that the scientific service should consist of five grades, with salaries rising from a minimum of 120*l.* to 800*l.* per annum, and that the fitness of candidates for entrance to it should be decided by a jury of men of acknowledged scientific reputation, independence, and integrity. This jury should make known in official reports the claims of the various candidates to advancement, thus securing public criticism, and removing all opportunities of intrigue or favour. Prof. Roscoe, F.R.S., then gave a lecture on Vanadium and its Compounds, exhibiting on the table the collection of these substances